

REMARKS

Claims 1 and 3-5 are presented for examination. Claims 1 and 3-5 are currently amended and Claims 2 and 6-11 canceled without disclaimer or prejudice. Claim 1 has been amended to incorporate the limitations of Claim 2, and to recite an “aqueous medium” (support at page 4, ¶ 3 and page 5, ¶ 3). Claims 3-5 have been amended in conformity with Claim 1 to recite “aqueous medium”. Claim 3 has been amended to recite “room temperature” (support at page 8, line 8 from bottom). The specification has been amended in the paragraph bridging pages 4-5 to replace mM with mL for the ionic liquid b (support at page 7, lines 8-9). No new matter within the meaning of § 132 has been added by the amendments.

Objection to Specification

The Office Action objected to the disclosure on page 4 of the specification because the term “ratio a/b” refers to a molar ratio whereas in the Example section, “ratio a/b” is defined as mMole/mL. The specification has been amended at page 4 to replace mM with mL. Of note is presently pending Claim 1, which recites mL for the ionic liquid b.

Objection to Claims

The Office Action objected to Claims 1-11 because the phrase “A method for concentration of . . .” allegedly does not describe the purpose of the invention. However, it is believed that the purpose is adequately set forth by the phrase “method of concentration” read in conjunction with “of fine particles dispersed in an aqueous medium”. Should the term “concentrating” instead of “concentration” be preferred; such amendment is proffered.

Rejection under § 112, ¶ 2

The Office Action rejected Claims 3, 6 and 9 as being indefinite for reciting the term “ordinary temperature”. Presently pending Claim 3 has been amended to recite “room temperature”. The rejection over canceled Claims 6 and 9 is moot.

Rejection under § 102(b)

The Office Action rejected Claim 1 as being anticipated by WO 02/34863 (“Boudreau *et al.*”) teaching a method for removing mercaptans from hydrocarbon streams using basic metal salts which react with mercaptans to form mercaptides, the salts being dissolved in ionic liquids. With respect to dependant Claims 3-5, the Office Action alleged that the reference teaches ionic liquids which are organic compounds that are liquid at room temperature. In this case, independent Claim 1 recites a “ratio a/b” to be 0.05, which is not taught expressly or inherently by Boudreau *et al.*, as acknowledged by the Office Action. See Office Action at page 5, ¶’s 15 and 17. Hence, the *prima facie* case of anticipation has not been established. The rejection is requested withdrawn.

Rejection under § 103(a)

The Office Action rejected Claims 2 and 6-11 as being unpatentable over WO 02/34863 (“Boudreau *et al.*”). Although the Office Action acknowledged that the reference fails to teach the claimed “ratio a/b” to be at least 0.5 (now incorporated into Claim 1), it was alleged that the molar ratio of a/b is the “ionic liquid absorption efficiency indicator” for each pair of particle/ionic liquid, where the higher the number, the better the performance of the ionic liquid

i.e., less amount to remove or extract the particles in dispersion.

This is incorrect because the claimed molar ratio of a/b would not have been considered by a person of ordinary skill to be a predictable solution with anticipated success. Neither is the claimed range of the molar ratio being at least 0.05, nor the fine particles being dispersed in an aqueous medium. Instead, Boudreau *et al.* teaches an amount of mercaptans to be removed from a hydrocarbon stream that depends on a thermodynamically decided value such as solubility. In contrast, the claimed invention relies on a ratio of a water phase to an ionic liquid phase. The ionic liquid of the claimed invention acts as a medium to separate nanoparticles where the amount of nanoparticles necessary for separation depends on the action of a functional group on the surface of the nanoparticles and ionic liquid molecules. In other words, the concentration of an aqueous medium relative to an ionic liquid is important. Boudreau *et al.* completely fails to teach or suggest this concept. It is also believed that the claimed concentration action is caused by electric charge characteristics. However, the claimed method cannot be applied to “a case containing soluble material to an ionic liquid as a material composing the fine particles”. See specification at page 6, lines 18-19. Simple substitution of one known element for another would not have yielded a concentration action, nor would have any other known techniques. The suggestion that the ratio a/b is merely an “ionic liquid absorption efficiency indicator” is merely an *ex post facto* observation. It would not have been “obvious to try” to make the claimed ratio a/b with a reasonable expectation of success. See In re Zurko, 258 F.3d 1379, 59 U.S.P.Q.2d 1693 (Fed. Cir. 2001) (holding an assertion of common knowledge cannot be relied upon to

overcome deficiencies in the prior art without evidentiary support).

Boudreau *et al.* also teaches away from the claimed invention. The reference teaches forming a solution of a basic metal salt such as sodium hydroxide in an ionic liquid, preferably a non-water reactive ionic liquid, and contacting the ionic liquid solution with a hydrocarbon stream in a manner which contacts mercaptans in the stream with the basic metal salt. Then, the resulting mercaptide salts are selectively dissolved into the ionic liquid phase (or water phase) from an oil phase. Hence, two steps must take place in Boudreau *et al.*: (1) dissolving sodium into the ionic liquid and (2) dissolving mercaptide into the ionic liquid. The presence of water in both steps is necessary because the solubility of mercaptide, which is a salt, in ionic liquid and the solubility of sodium hydroxide in ionic liquid, are both very small. The ionic liquids used in Boudreau *et al.* includes for example, an ionic liquid where BF_4^- is the anion source. Controlling the amount of water is relatively easy because the BF_4^- anion is soluble in water. For an anion source like PF_6^- the water solubility in ionic liquid is very small because of its hydrophobicity. For PF_6^- , if the amount of water is increased beyond a certain limit, a three phase solution of an oil+water+ionic liquid is formed where mercaptide is dissolved in the water phase. The claimed invention is not similarly limited. Another critical difference is that the mercaptides once dissolved in the ionic liquid are oxidized to form disulfides requiring the use of a cobalt-phthalocyanine catalyst. However, mercaptides hardly dissolve in the ionic liquids alone because an ionic salt generally shows very poor solubility in an ionic liquid, *e.g.* NaPF_6^- in an ionic liquid. Hence, a cobalt-phthalocyanine catalyst, which can be dissolved in the ionic liquid,

is used to form the disulfides where oxidation of the mercaptides to the disulfides is promoted by the catalyst. In other words, the ionic liquid of Boudreau *et al.* alone cannot dissolve mercaptide (the intended target) whereas in the claimed invention, the fine particles can be dissolved by the ionic liquid.

Conclusion

In light of the foregoing, it is submitted that the application is now in condition for allowance. It is therefore respectfully requested that the rejection(s) be withdrawn and the application passed to issue.

Respectfully submitted,
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